



Contrasting urban and rural heat stress responses to climate change

Author(s): Fischer EM, Oleson KW, Lawrence DM
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Abstract:

Hot temperatures in combination with high humidity cause human discomfort and may increase morbidity and mortality. A global climate model with an embedded urban model is used to explore the urban-rural contrast in the wet-bulb globe temperature, a heat stress index accounting for temperature and humidity. Wet-bulb globe temperatures are calculated at each model time step to resolve the heat stress diurnal cycle. The model simulates substantially higher heat stress in urban areas compared to neighbouring rural areas. Urban humidity deficit only weakly offsets the enhanced heat stress due to the large night-time urban heat island. The urban-rural contrast in heat stress is most pronounced at night and over mid-latitudes and subtropics. During heatwaves, the urban heat stress amplification is particularly pronounced. Heat stress strongly increases with doubled CO₂ concentrations over both urban and rural surfaces. The tropics experience the greatest increase in number of high-heat-stress nights, despite a relatively weak similar to 2 degrees C warming. Given the lack of a distinct annual cycle and high relative humidity, the modest tropical warming leads to exceedance of the present-day record levels during more than half of the year in tropical regions, where adaptive capacity is often low. While the absolute urban and rural heat stress response to 2 x CO₂ is similar, the occurrence of nights with extremely high heat stress increases more in cities than surrounding rural areas. Citation: Fischer, E. M., K. W. Oleson, and D. M. Lawrence (2012), Contrasting urban and rural heat stress responses to climate change, Geophys. Res. Lett., 39, L03705, doi: 10.1029/2011GL050576.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Meteorological Factors, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

Climate Change and Human Health Literature Portal

resource focuses on specific location

Non-United States

Non-United States: Africa, Europe

African Region/Country: African Region

Other African Region: Northern; Tropical

European Region/Country: European Region

Other European Region: Northern; Southern

Health Impact: 

specification of health effect or disease related to climate change exposure

Morbidity/Mortality

Resource Type: 

format or standard characteristic of resource

Research Article

Timescale: 

time period studied

Time Scale Unspecified